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Toward a Theory of Pedagogical Reduction: Selection, Simplification, and Generalization in an Age of Critical Education

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ABSTRACT. In this article, David Lewin examines the processes of educational representation, simplification, and selection, proposing the term “pedagogical reduction” in order to clarify the role these processes play within pedagogy. Although this term is virtually unknown among Anglo-American educational theorists, it reflects a substantial theoretical basis in the related German concept *didaktishe Reduktion*. Drawing on sources from the hermeneutic tradition, Lewin argues that education is fundamentally an interpretive exercise since selection and simplification require the interpretive judgment of educators, and that the hermeneutic constraints applied to education entail forms of reduction. He then examines pedagogical reduction within the curriculum areas of history, science, and philosophy in order to illustrate the generative and generalizing nature of pedagogical reduction, which takes students from particulars (objects, exercises, or events) to general or universal principles. Lewin discusses Comenius’s 1658 textbook *Orbis Sensualism Pictus* in order both to illustrate pedagogical reduction as a historical form as well as to draw attention to a key historical moment in the development of educational representation and reduction. He then turns to an examination of skepticism of pedagogical reduction from progressive and critical pedagogies. The argument

culminates in the suggestion that educational theory is too often presented with a false dilemma: either accept the need for a contrived educational experience disconnected from the experiences and concerns of life, or react against this flattened educational aspiration by seeking something authentic and progressive that meaninglessly conflates education and life. Understanding the proper place of reduction in education, Lewin concludes, is vital in mediating this dichotomy.

Introduction

We live in a complex world. One of the fundamental questions educators must consider is one of educational representation: how is the complexity of things to be made understandable to the next generation? This article will examine some ways in which educators present and represent the world to the young. The acts of presenting and representing in education could be boiled down to the efforts to draw the attention of students to particular things, efforts that involve various forms of selection and simplification aimed toward general understanding. This variety of activities undertaken to simplify complexity is here referred to as *pedagogical reduction*. Although the processes of pedagogical reduction — of selection, simplification, and generalization — are activities that most, if not all, educators would immediately recognize, there is relatively little theory of educational representation and reduction among Anglo-American educational theorists.[1] German language educational theory tends to theorize this conception more explicitly by exploring the related term: *didaktishe Reduktion*; again, though, this term (and its English equivalent: *didactic reduction*) has not been commonly translated into, or taken up by, the English-speaking world. If it is true that most educators would immediately recognize pedagogical reduction, why does it matter if a corresponding theory is absent? It is not the case that theoretical discourse concerning pedagogical representation is absent, however; rather, such theory tends to take the form of critique: progressive and critical pedagogues are disposed to focus analysis on normative questions of the failures of

representation, from critical analysis of whose interests govern pedagogical representations, to how we can avoid constructing an inauthentic educational reality disconnected from a putative real world. For instance, a hermeneutics of suspicion is applied to the interests that determine the structure and content of textbooks. Although a critical attitude is often appropriate, I argue that the impact of the absence of a more general descriptive theory of pedagogical reduction is that insufficient consideration is given to the appropriate nature and scope of pedagogical reduction. In other words, while critics are apt to point out that the content of curriculum is complex and contested, representing unacknowledged and prejudiced canonical interests, there is seldom an explicit recognition and justification of the need for pedagogical reduction per se. In what follows I argue not only that a theory of pedagogical reduction is valuable, but that we cannot understand or practice education without it. The central claim of this article can be reduced to this: that pedagogical reduction is unavoidable in thinking about, or practicing, education.

The argument begins by making the case for using the term "pedagogical reduction," first, by examining the concept of reduction more generally and, second, by showing how it can be helpfully applied to educational theories and practices. I illustrate the concept of reduction in education through a number of examples to illustrate the key principles of selection, simplification, and generalization. I then go on to show how the construction of pedagogical reductions is given archetypical form in the textbook. I discuss the first textbook for children published in 1658, Comenius's *Orbis Sensualium Pictus*. The publication of this text is significant because it has been associated with the shift from presenting the world to children to a more self-conscious and explicitly pedagogical *re-presentation* of the world,[2] thereby providing an illustration of the origins of systematic pedagogical reduction. The argument then goes on to address how modern forms of critical and progressive education tend to obscure this significant educational process.

Pedagogical Reduction

The term reduction is used both as a verb (to reduce something by making it smaller or simpler) and as a noun (the object that has been reduced). It contains the verb stem *educe* which literally means to "draw out, extract; branch out."[3] This etymology ties reduction to education in a very direct way. The Latin etymology refers to the idea of "bringing back, or restoring," employing *ducere*, meaning "bring, or lead out." Thus, to *reduce*, to *educe*, and to *educate*, each connote drawing or bringing something out. By drawing attention, education is a generative reduction of the world that draws out through constraint: an enabling constraint. This emphasizes the verbal process, but I also want to keep in mind that reduction is a helpful term for the objects that result from the process. Textbooks are probably the paradigmatic form of the pedagogical reduction, but before I examine this form, let me briefly illustrate the concept in a variety of contexts: museums and galleries use light and space in particular ways to draw attention to certain things with pedagogical intention; children's toys often present elements of the world in miniature, again based at least partially on pedagogical or developmental interests; children's moral tales are often designed to simplify complex dilemmas or sanitize darker instincts with formative influences in mind; children learn to ride with "balance bikes," bikes that have the complexity of gears, pedals, and brakes removed for pedagogical purposes. Let me develop further the example of the balance bike.

Although something like the balance bike has existed nearly as long as cycling itself, the modern form has become pedagogically popular as a stage of learning in recent years. It seems that the popularity of these bikes can be explained by a shift in how the process of learning to ride a bike is understood. Learning to ride is often understood to build upon the fundamental skills of balance and steering. Once they are developed, then other skills — pedaling, braking, and gears — can become the focus. Prior to the development of the balance bike, stabilizers (also known as training wheels) were (and still are) commonly used, though increasingly it is recognized that to remove the element of balance from the early stages of learning to ride is counterproductive.[4] Although stabilizers enact a pedagogical reduction, their use is arguably not

as effective as balance bikes for the intended purpose (learning to ride a bike). In any case, these bikes are used to simplify by breaking down a complex activity into constituent parts that are presented in a staged manner.

It is more common to see pedagogical representations and reductions in more "bookish" forms of knowledge. Consider Daniel Tröhler's distinction between "research knowledge" and "pedagogical knowledge." Tröhler argues that research knowledge is generated by questioning existing knowledge using verifiable scientific methods, resulting in new, but still provisional knowledge. This kind of knowledge is contrasted with pedagogical knowledge whose chief characteristic is to be "combined, arranged and structured for the purpose of effective teaching."[5] The presentation of pedagogical knowledge, often in textbook form, follows certain principles: the knowledge is stable, not provisional or contested; exceptions and contradictions are avoided; elements are presented in discrete parts or units; the presentation itself is often attractive or entertaining in some way. The forms of pedagogical knowledge can be summarized as the "[s]election, condensation, composition, didactical structuring and streamlining for classroom instruction."[6] This distinction between research and pedagogical knowledge can be overstated: one must keep in mind that as soon as one attempts to communicate research knowledge, one is thinking about how it is to be best presented and so questions of pedagogical representation are never too far away. Conversely, pedagogical knowledge is not disconnected from research knowledge as though it is only concerned with the mechanics of effective communication: even pedagogical knowledge is about something in the world. Nevertheless, the distinction is useful and visible in all sorts of contexts. Tröhler's definition of pedagogical knowledge emphasizes the intentional nature on the part of educators to restrict the presentation of some subject matter.[7] Educators do not simply show what they know, or allow the whole world to come into appearance, rather they intentionally select what they think is worthwhile or important. Shaun Gallagher calls this the "noncoincidence between her [educator's] understanding and her presentation."[8] At first sight, it seems reasonable to suppose

that an educational re-presentation is likely to be a reduced subset of the educator's fuller understanding. Math educators, for example, must consider which aspects of their understanding to present, though even here the ability to effectively re-present subject matter requires considerable mathematical capacity, complicating the image of education as the presentation of a subset of understanding.[9]

Tröhler describes the Heidelberg Catechism as "a prime example of an educational work or 'textbook' that treats knowledge pedagogically"[10] since it elides the theological controversies of the Reformation, re-presenting the gospel in accessible and uncontested form. We are more likely to be familiar with the ways secular textbooks embody pedagogical reduction, rendering fields of knowledge into particular curricula. Educators make judgements about the kinds of interpretation of the world that most effectively support the students, and the sequence in which those interpretations are best presented, by providing select narratives and examples.[11] The concept of the curriculum exemplar illustrates well how a particular example is used to refer students to a general principle or idea. In presenting the concept of exemplarity, I have in mind what Martin Wagenschein has called "teaching to understand."[12] Here Wagenschein warns against two tendencies that would challenge the pedagogical reduction: (1) the propensity to view learning as a linear movement from simple to complex, and (2) the temptation for completeness. In discussing the first tendency, Wagenschein argues that there are pedagogical reasons to encourage students to encounter a small amount of relative complexity in detail early on so that certain principles of understanding are formed — what is sometimes colloquially called a *deep dive*. At first glance, this approach does not seem consistent with the notion of a reduction of complexity, but in fact not only does it highlight selection and re-presentation, it also describes how a field is reduced to some exemplary episode in order to help the student understand it more broadly. Regarding the second tendency, no curriculum can be described as *complete*, but educators who do not theorize reduction sufficiently are often too optimistic about the promise of completeness, hoping to provide students with something like a full account of a

field. These considerations of the formation of understanding present an interesting contrast to the example of the balance bike and suggest an important place for the process of generalization. For generalization to take place, educators must draw attention to particular events, episodes, or examples, indicating that generalization is both a kind of reduction and a kind of expansion. As with a telescope or microscope, by elimination and reduction, we can see that much more.

I have argued that pedagogical reduction in some form is widely practiced but is insufficiently theorized. In essence, the problem with a lack of theory here is a tendency to let prejudice or commonsense practices lead the process of pedagogical reduction. In addition, this process is relatively untheorized within Anglo-American educational theory because of a tendency to move too quickly to the critique of ideology.[13] By this, I mean that analysis of the selections and simplifications of pedagogical reduction are equated with the sociopolitical questions of whose interests govern those selections and simplifications,[14] sometimes overlooking important aspects of what exactly such selections and simplifications involve.[15] After we have developed a fuller conception of pedagogical reduction, we will turn to these critical concerns by discussing progressive and critical pedagogy. But even those theorists who would recognize the role of the educator might not immediately draw upon the term I am advocating. Klaus Mollenhauer, for instance, makes a great deal of the idea that education is characterized by a process of presentation and representation, emphasizing the interpretive dimension of education and the vital role that the educator plays. However, Mollenhauer's emphasis is on the pedagogical *relation* rather than the pedagogical reduction (a term he does not use).[16] But it is clear that the pedagogical relation entails some kind of authority to determine "what appears to us to be tolerable or worth pointing out to children."[17] Determining what is (or is not) important or worthwhile is part of showing the world since every pedagogical showing entails judgment. Mollenhauer emphasizes the role of the educator as the one who provides an interpretive re-presentation, without referring to the concept of pedagogical reduction.

Despite the fact that the term does not appear in Mollenhauer's text, the German *Didaktik* tradition has developed a theoretical literature around a term very similar to pedagogical reduction — *didaktishe Reduktion*[18] — which suggests there is value in bringing this tradition into further dialogue with the Anglo-American context. Consider, for instance, the following:

> In discussion about the curriculum, the main problem is choosing and justifying the content. Everyone expects the teacher to "simplify" and "elementarise." In what follows I consider simplification as the process of making accessible. I do not touch upon simplification in the sense of pruning or "stepping down to a lower level."[19]

Here, Arnold Kirsch introduces a discussion of simplification within the context of math instruction. This writing, first published in 1976, reflects the more developed consideration of pedagogical representation and reduction that exists in the German *Didaktik* tradition. In developing this argument, I hope to encourage further dialogue between that tradition and my own (education studies within the Anglo-American context).[20]

There are other reasons to consider using the term pedagogical reduction, as well. In the introduction, I referred to the idea of pedagogical reduction as a constraint that enables. Gallagher argues that hermeneutic constraints "both limit and enable the processes of interpretation and education" through binding us to the traditions that provide the interpretive context for our being-in-the-world.[21] If a tradition or education constrains how we understand or interact with the world, then it seems reasonable to call that constraint a kind of reduction. *Reductionism*, and generalization, might even be said to be intrinsic to understanding and interpretation as such.[22] In addition to this, I have already attempted to explain the concept of the pedagogical reduction by referring to the role educators play in distilling the complexity of the world primarily through the concepts of simplification and selection. The concepts of simplification and selection seem to me *prima facie* aspects of subtraction and, therefore, of reduction. Furthermore, ideas around pedagogical knowledge and the noncoincidence of

educators' understanding and their re-presentation provides further insight concerning what is meant by simplification: the educator does not say everything he or she might about a particular subject, just as the balance bike does not provide access to all of the practices that cycling comprises. However, a serious objection might be that the idea of a subtraction, or (re)presentation of only a selection of the educator's understanding, encourages a reified concept of education, that is, of being content that can be added, subtracted, transferred, and so on. We might run into problems if we suppose that there is a stable body of knowledge from which selections and simplifications are made. But the concept of pedagogical reduction describes a process and product in terms that do not rely on a reified body of stable knowledge. Translation and interpretation are essential ingredients in this re-presentation of the world, and these terms might better capture the idea of reduction in some contexts. However, the balance bike example is helpful in showing that the pedagogical reduction can be embodied; the bike is the result of an intentional concern to affect a student's relation to some subject matter (in this case, learning to ride a bike), even where that subject matter is not clear cut or stable. This is why we might also refer to reduction as a kind of showing. From the perspective of hermeneutics, the relation (between the student and the ability to ride a bike) already exists, albeit as something of an absence. The reduction is offered as a way to assist a change in that relation. Such a change is not simply a transferal of skill from educator to student, but entails a change in the relation between the student and the subject matter of knowing how to ride.

The processes of simplification and selection entail a further pedagogical operation that I have only briefly touched on so far — namely *generalization*. Consider, for a moment, the context of perception, whereby the representation of sensory data in constructing experience describes the process of seeing objects *as objects*, a process that is both reductive and generalizing. One might even say that in perception the phenomenological reduction constitutes the generalization, and here the connections with the role of schema within the processes of education are suggestive. According to Jean Piaget's conception, schemata, — structures of

thought into which new experiences are assimilated, and which must, at the same time, accommodate themselves to the new — are forms of constructing experience that are educational.[23] It is in this context that the association of reduction with generalization, from diverse classroom experiences (examples, experiments, episodes) to a general principle, can be developed. This has particular significance for education since it is fundamentally concerned with a reduction from the many experiences of the world that are possible to understanding general principles and norms that lie "behind" and structure those experiences. In addition, processes of generalization are closely aligned with processes of induction that are also worth developing.

In *The Textbook and the Lecture* Norm Friesen describes the development of the pedagogical process of induction by looking at the evolution of the textbook. Friesen draws attention to how the modern textbook often begins a topic by asking readers to reflect on their own experiences of some particular issue, going on to show how those experiences are addressed in the general categories presented by the matter of the textbook.[24] For Friesen, this approach reflects the inductive method that begins by way of a reduction: the particular experiences of the learner are the point of entry from which more general understanding can be induced. Friesen shows this inductive method to be reflective of Johann Pestalozzi's theory of education in which the student moves from particular sense impressions to various levels of abstraction.[25] As I will discuss in the next section, scientific and mathematical education illustrate well how induction works not through an encounter with the principles of science or math directly, but through an experience of the particular reductions of science and math in the figures, forms, and experiments that give indications of the principles that stand "behind" them. Experience and understanding appear, then, to be in tension with one another since understanding generalizes and therefore reduces from experience.

The reasons for proposing the term pedagogical reduction can be summarized as follows: the term provides a clear understanding of the processes and results of simplification,

selection, and generalization, and helps us to direct more conscious attention to the criteria determining pedagogical reductions. I will briefly illustrate these issues in particular curricula domains — history education, science education, and philosophy education — so that the movement (or dialectic) between particular experiences and the principles or universals for which those experiences stand can be observed.

Pedagogical Reduction in Practice

Arguing for the elevated position of *poetry*, Aristotle said that history concerns only the particular while poetry concerns the universal.[26] In reference to history *qua* history, this argument might be convincing, but when examining distinctly pedagogical questions, history looks very different. Drawing again on the point that education directs the student to what the educator thinks is important or appropriate at any given stage, and applying this observation to the context of teaching history, the educator's concern is less the particulars than the principles that those particulars point to. Resisting the temptation of completeness, students are not expected to learn every historical event or detail, and so part of a pedagogical reduction will be the choices educators make when introducing students to exemplary historical moments. Here I emphasize that the details express something significant that the educator wishes the students to learn. The details of the particular event may well be less important than the more general, universal themes. For instance, a class about the suffragettes, about civil rights, or about British rule in India all might be used to illustrate the fragility and contingency of our notions of democracy and justice; alternatively, they might be used to reinforce certain nationalist narratives and ideologies that educational authorities take to be essential. In such cases, historical detail is often a vehicle for making broader points. The details may add a certain color, texture, or interest, and so may have important mnemonic significance, but the real lesson of the class is general. An important task of the educator is to select the most exemplary form of the principle at stake. Curricula selections are chosen on the basis that they have significant power of exemplarity.

A similar structure can be detected in science education. Students are led to an understanding of scientific principles by way of pedagogical reductions. Of course, students enter “science” through subject and topic domains, and through structured curricula with particular elements that provide a view of the field. Here, principles or natural laws are illustrated through certain experiments or pieces of data. Principles of electricity, for instance, are demonstrated through particular objects or experiments (for instance, using lemons, wire, and a lightbulb to show the process of electrolysis), or the principles of evolution are illustrated through the diverse shapes of the beaks of finches on different islands.

In philosophy, we can see that the principles of human knowing and decision making are often illustrated by way of particular events, episodes, and examples: experiments in logic, for example. The educator engages in pedagogical reduction by selecting, say, the famous trolley-car scenarios in ethics. These scenarios illustrate the ways in which decisions are often rooted in utilitarian or rights-based reasoning. Again, the educator’s concern is to illustrate and explore the forms and conditions of reasoning more than the particulars of the trolley-car scenarios themselves.

I have been arguing that the reduction of the particulars to the principles behind them can be seen not only as reduction, but also as generative, as a kind of expansion, since the principles offer a wide application and allow students to “see” further. Grasping a general principle expands the perceptual schema: an understanding of the principles of evolution, for instance, allows us both to notice the structure and detail of the world, and to observe with finer attention since more detailed phenomena “fit in” rational schema; an understanding of the principles of decision making better equips us to perceive the ways in which human agency is constituted and influenced. This explains not only that perception reduces to understanding, but also indicates the educational *formation* of perceptual schema through intentional pedagogical activities (learning to see).

In history, science, philosophy, and (arguably) across the entire school curriculum, the educator's prime concern is to engage students with generative principles. This appears to be a familiar process of induction, but it raises pedagogical questions. What is the educator introducing the student to? What is made visible in the pedagogical act of drawing attention? Is it the particular examples and experiments, or general principles or forms? The reduction seems to be a process of induction: the particulars of the case are reduced to a general principle. The educator will hope that the reduction is sufficiently meaningful to the student, and that it has also the character of an expansion. One might object that this kind of induction or expansion is not helpfully identified with the idea of reduction. It is true that the educator presents a reduction of the world in order to bring about something like an expansion. But a generalization can be usefully seen as intrinsically reductive, since we no longer look at the individual cases on their individual merit, but as part of a general narrative. The ascent of the mind might not, in itself, be best described as reduction, but that ascent is something of a mystery within education, since its presence and effect are matters of speculation: we don't really know what takes place in the event of understanding, but I think we can be confident that this event depends upon acts of reduction.

The efforts to define the structures of selection, simplification, and generalization in terms of the pedagogical reduction suggest a great deal more that could be said about the practices of pedagogical reduction. Here, I can only briefly touch on one important practical question, namely the practical wisdom (*phronesis*) that educational practitioners develop through experience and reflection on experience. In his account of *pedagogical tact*, John Herbart described the importance of practical wisdom, noting that such wisdom is vital in deciding when and how to use pedagogical representations and reductions.[27] Because of the ambivalent nature of the textbook reduction (that it both reveals and conceals), it is essential that educators pay attention to the students' relation to the reduction in order to determine when to give and to take that particular pedagogical form. The Heidelberg Catechism, as noted

previously, is an important pedagogical tool; still, that it cannot serve as a substitute for the gospel is equally true. Good teaching, therefore, entails the appropriate use of the pedagogical reduction at the right moment.

It has been argued that it was only around the age of the European Enlightenment, as schooling became more formalized and universal, that the question of how the complex world ought to be pedagogically represented became urgent. Is this a consequence of the development of science and later industrialization? Is this to do with the breakdown of the unified theological order of Christian cosmology (the Aristotelian–Ptolemaic cosmology undone by the Copernican revolution)? How is this related to the emergence of childhood as a distinct phase of life whose innocence is to be protected, and for whom the world in miniature is made present in manifold ways (for example, through toys)? To what extent is mass state-sponsored education the real driver of the question of how to represent the world to the young? Arguably, all of these questions play a role, but I refer again to Mollenhauer at this point since he touches on many of these questions when developing an important point: that self-conscious pedagogical representation was not widespread until around the mid-seventeenth century.

The Pedagogical Reduction in Comenius

Mollenhauer has argued that a new pedagogical age dawned with Johan Comenius's publication of *Orbis Sensualium Pictus*, often regarded as the first textbook for children. At this point, according to Mollenhauer, we first see children not just present to the world, but having it re-presented to them. In the transition from presentation to representation, Mollenhauer says, we see the "social construction of an educational reality" for which "specialized institutions are needed: schools (no longer for a tiny minority: now children from the urban middle class)."[28] Although Mollenhauer does not refer explicitly to the concept of the pedagogical reduction, he does refer to the associated idea that schools became spaces for "pedagogical rehearsal":[29] educational spaces are not "real world" spaces since they are set apart precisely in order to offer students the opportunity to rehearse complex actions, knowledges, and attitudes before

they are performed for "real." These processes of, and spaces for, representation, reduction, and rehearsal are vital to understanding the appropriate scope of pedagogical reductions. Mollenhauer's reference to Comenius is significant for my argument since *Orbis Sensualium Pictus* exemplifies all the features of the pedagogical reduction: selection, simplification, and generalization. Indeed, Mollenhauer frames his discussion of Comenius around the key questions that have occupied us here: "Of all the things there are to learn, which ones are truly important[?]" (selection) and "How can these be conveyed with the needed clarity[?]" (simplification).[30]

First published in 1658 in Latin-German, and then, only one year later, published in Latin-English, *Orbis Sensualium Pictus* — normally translated as *The Visible World in Pictures* — is one of the first pedagogical works for children, and it is a curious text when it comes to the question of representation. The text concerns, as the title page has it, that which is obvious to the senses, including divine things. If we are to consider *Orbis* as a generative pedagogical reduction, providing a representation of the world, we must ask what is the organizing structure of this generative representation? Unsurprisingly, the structure of the book reflects the organization of the late medieval/early modern cosmos. Following an exhortation to wisdom,[31] the text addresses the reader to very concrete and visible matters. Beginning with what might be read as an early version of "Old Macdonald Had a Farm," drawings of different animals are presented along with their names and characteristic animal sounds. This introduction to the sounds is linked to the alphabet by way of the naming of familiar animals (the text explicitly references Adam's naming of the animals in the book of Genesis[32]). This is immediately followed by an analysis of God in himself (as Blessed, everlasting, spiritual, and so on). The text moves on to creation (heaven and earth), followed by the elements (fire, air, water, vapor, earth), and through a list of inanimate and animate objects, to human beings, then to things arising through the interaction with things, onto objects of higher culture and learning, virtues, and social ideas, culminating in religion. Organized along the lines of the great chain of being

and the order of creation in Genesis, everything here has its place in the cosmic hierarchy, while also being systematically presented for pedagogical purposes.[33] This systematic representation of the world can be regarded as complete, offering the child access to both the symbolic order of literacy, as well as the universals that encompass everything. Noting that the text is organized both ontologically and pedagogically is itself an acknowledgment that for Comenius ontology is intrinsically pedagogical since, from the perspective of late medieval to early modern philosophy, Divine providence ensures that the organization of things is toward being known (and being learned). The intention of *Orbis* is primarily to say something true about the world, which indeed is explicitly stated as the first principle of the teaching of the text itself.[34] In order for the entire cosmos to be reduced to a textbook, *Orbis* must be capable of representing the order of things. We may struggle to see everything enfolded into the modern textbook, but, at least for Comenius, *Orbis* is there to mediate a universal order and to bring essences into view. In other words, the pages of the book refer to what is often taken to be invisible: universals that particular objects provide instantiations of.

It is clear that Comenius carefully considered the key pedagogical questions (what should be presented and how), reflecting directly our concerns of selection, simplification, and generalization. But he lived at a time when the order of the world was still thinkable, even if fractured by the nascent rise of science and modernity. Today, it seems that we no longer assume this order to underpin general education, and so the selections and simplifications are organized by other principles — such as utility, preference, interest, marketability, or power — raising questions that later came to define the concerns of critical pedagogy. My point here is that the organizing principles for determining reduction and re-presentation can be radically variant, but, despite the contrast, the fundamental structure of reduction for pedagogy pertains to both pre- and postmodern. The pedagogical reduction of Comenius's text offers us a perspective of the whole by way of the parts arranged in a particular order, vividly illustrating the principles that can be observed in subsequent representations in the history of the textbook. For

Mollenhauer, the significance of *Orbis* is partly its role in the history of the formation of pedagogical representations of the world, and so it can be seen as exemplary of a pedagogical reduction as defined here.

Comenius can be said to be among the first to employ reduction in a systematic and explicit fashion, but, as has been seen, the concept has been developed by others, most notably perhaps by the best-known American philosopher of education, John Dewey. In *Democracy and Education*, Dewey says:

> the inequality of achievement between the mature and the immature not only necessitates teaching the young, but the necessity of this teaching gives an immense stimulus to reducing experience to that order and form which will render it most easily communicable and hence most usable.[35]

And in reference to school:

> The first office of the social organ we call the school is to provide a simplified environment. It selects the features which are fairly fundamental and capable of being responded to by the young. Then it establishes a progressive order, using the factors first acquired as means of gaining insight into what is more complicated.[36]

We need to keep in mind that the critiques from the perspective of "progressive education," such as they are, should be moderated by examining what Dewey, the oft-proclaimed father of progressive education in America, and others labeled "progressive" might have to say. What follows is not a direct response to issues with the "pedagogical reduction," but an examination of certain orthodoxies within progressive and critical pedagogies and how they are in tension with this account of pedagogical reduction.

Critical Concerns

It is not possible here to give a full treatment of the various critical positions across progressive and critical pedagogies, and so in what follows I rely on generalizations (pedagogical reductions, if you will) that could be disputed by offering counterexamples. The

argument is, therefore, little more than suggestive of some general problems concerning how progressive and critical pedagogies sometimes conceive the interpretive necessities of curriculum selection, simplification, and generalization. Moreover, much that will be considered here has already been anticipated, so the task now is to connect, highlight, and respond to those issues that reduction is likely to raise.

The practical issues concerning the appropriate use — that is, the "give and take" — of pedagogical reductions, and the faculty of pedagogical tact in making judgments about them, raise again the fundamentally interpretive nature of educational re-presentation. Education is intrinsically interpretive, or hermeneutical, in nature since every form of teaching and learning entails unavoidable interpretation. In other words, there is no standing outside of the hermeneutical circle, either for the teacher or the student who are both placed, or who find themselves, within horizons of understanding. In turn, within education there is no standing outside the pedagogical representation (and reduction) of the world. This point is essential when examining critical theories of education since it draws attention to the fact that critical reflection itself is always bound by hermeneutical constraints, acknowledging that there is no place outside of the structures of authority and power. This should lead us to consider how authority and power is properly located and exercised, rather than whether we can be fully emancipated. Although critical thinking "prescribes suspicion rather than trust,"[37] as Gallagher succinctly puts it, the trust I would advocate is not trust in any particular interpretation or reduction, but in the structural need for interpretive reduction as such.[38] Of course, critique still plays a role in determining the particular nature and scope of pedagogical reduction. However, Jürgen Habermas's critical hermeneutics has been influential among critical theorists of education, some of whom ultimately seek forms of radical emancipation from power and authority within education.[39] For the purposes of this argument, the general result is that progressive educators and critical pedagogues (at least in certain forms) do not acknowledge the general structure of education as necessitating reduction. In an age in which educational authenticity is generally

espoused, any notion of reduction in education is regarded with suspicion. The kinds of selection and simplification discussed in this article entail significant normative considerations: what is explicitly and implicitly valued by the selection process, and whose interests are thereby served? Such normative questions are addressed by critical pedagogues who wish to denounce implicit value structures as ideological. Before coming to examine that critique in more detail, I want first to consider progressive education by looking at the concept of authenticity.

Despite the views of Dewey already expressed, it is not uncommon among progressive educators to claim that education should strive for authentic experience of the world and that the educational space should be, as far as possible, continuous with, or indistinguishable from, a putative real world. In his book *Shop Class as Soulcraft*, Matthew Crawford begins with a quotation from Doug Stowe that captures something of this tension: "In schools, we create artificial learning environments for our children that they know to be contrived and undeserving of their full attention and engagement.… [T]he world remains abstract, and distant, and the passions for learning will not be engaged."[40] The idea that schools are artificial, inauthentic places that present abstract ideas disengaged from the world has become a common critique within progressive education. Such complaints must be taken seriously, though not uncritically. They aspire to make education "real world" rather than abstract or rehearsed, but these critical interruptions tend to throw out the baby with the bathwater, since the learning environment also works precisely through contrivance and abstraction. Contrary to this desire for authenticity, I suggest that if reduction leads to inauthenticity, then education could be taken as intrinsically "inauthentic." It is precisely because the original concept of schooling suggested a space and time in which the assumptions and practices of the supposed "real world" can be interrupted that recent educational theory has begun to (re)make a coherent defense of school, as in the Greek concept *scholè*: free time, rest, delay, study, discussion.[41] Ilmi Willbergh has provided an analysis of the appropriate deployment of authenticity in education that further makes the point: "it may be claimed from the Bildung perspective that instruction should be inauthentic to make

possible an authentic meeting between student and content…. [T]he object is taken out of its ordinary context and placed into a new institutionalised context."[42] Nevertheless, and to recognize the legitimate concerns of progressive education, the foremost criterion for determining the worth of these efforts to interrupt should, in the words of Wolfgang Klafki, be "whether the activities can come alive and be effective *outside* the school's walls."[43] But this concern may be addressed more effectively by Willbergh's authentic meeting between student and content than by some putative authentic encounter with the world. And, of course, the concept of *authentic encounter* is a matter of judgment that requires some kind of educational intervention. It is necessary that someone (the educator) considers whether the lesson will indeed be of significance for the student's future, since this is difficult to do for oneself,[44] a point that also undermines some stronger conceptions of child-centered education. Throughout this article, I have implied that a legitimate dimension of the educator's authority lies in the intention to present pedagogical reductions, but how far is this a legitimate exercise of educational authority? This question links the progressive critique to that of critical pedagogy.

The authority of the educator to define what and how to show the world could be a criterion for making the controversial distinction between higher and lower cultural forms, through the curation of a canon; a perspective focused not so much on, as Matthew Arnold's oft-quoted phrase has it, "the best that has been thought and said,"[45] but instead on *exemplary* episodes in history and culture. Here "best" is directed to a *pedagogical* rather than to an absolute/cultural evaluation, thereby acknowledging the educator's necessary role in pedagogical reduction. Much as progressive educators might seek to disavow educational authority in this way, or critical pedagogues might draw attention to the hegemonic nature of this selection process or of evaluative ascriptions of "high art," this view of pedagogical reduction seems both irresponsible and impossible to entirely disavow, and, indeed, something that the student hopes for, if not quite demands, from the teacher. From this point of view, reduction is intended to make some aspect of the world available to the student, despite the fact that

reduction and representation are sometimes associated not with revealing the world, but with concealing it. This brings us to consider the concerns of critical pedagogy.

Critical pedagogy has a direct concern with demystifying the sociopolitical interests and hegemonies that govern the pedagogical reduction. Those hegemonies determine the manner in which curricula are formed, governing the selections and simplification on the basis of criteria that, so the argument runs, are inherently ideological. Such criticisms can be found in the work of a range of theorists such as Paulo Freire, Ira Shor, bell hooks, Michael Apple, and Henry Giroux, among others, and they coalesce around a concern to bring about some kind of critical awareness of the hegemonic nature of education as currently practiced. Concerning reduction, they argue that the authorities who select are not representative since they are constituted by a narrow social grouping and thus yield selections that reflect narrow interests. Giroux, for instance, says that "[w]hile all of the learning skills are important, their limitations as a whole lie in what is excluded, and it is with respect to what is missing that the ideology of such an approach is revealed."[46] These concerns around selective exclusion are related to wider issues of the reproduction of power, since the selections that define "culture" reproduce ideology.[47] I am not denying the importance of acknowledging where a given educational canon is disproportionately constituted by figures from certain groups in society, as well as the tendency to reproduction. Recognizing these critical issues does not, however, absolve the need for reduction as such. It is perhaps easier to rail against those authorities governing pedagogical reductions in general than to offer a rationale for different choices concerning a necessary reduction. It is too easy to interpret critical pedagogy as lifting the veil, or revealing the truth, without recognizing the principle of hermeneutics that my account of reduction builds upon — namely, that revelation of the world always entails a different reduction; or, as Martin Heidegger put it, that every revealing is also a concealing.[48] This is to recognize our hermeneutic condition: that interpretation, reduction, and education belong together. There is a danger that critical pedagogy is understood to be doing away with the pedagogical reduction itself, thereby failing to

recognize both the generative capacity of reduction and the hermeneutic dimensions of critical pedagogy. In fact, critical pedagogy can (and often does) work not to disavow educational authority, but to reinterpret it to make it more representative of the public that it embodies,[49] and so should not be seen as critical of reduction as such. Indeed, the general view of critical pedagogy — that education is inherently political — attests to the need for a reduction, though that politicization must be seen in its complexity, as *constituting* the pedagogical responsibility, not *contaminating* it.

Anglo-American educational theory has developed a wide range of analytical resources to use in critically interrogating the structures and practices of education. What requires more analysis is the systematic consideration of educational relations and structures themselves, a situation that this article attempts to begin to redress.

Conclusion

The need for a theory of pedagogical reduction is justified on the basis that an absence of theory will lead to practices that are haphazard and prejudiced. Critical pedagogy can surely contribute to the development of such a theory, but only in response to a better articulated description of reduction first. Otherwise, educational theory can seem to face a false dilemma: either accept the need for a contrived educational experience that is disconnected from the actual experiences and concerns of life, or react against this flattened educational aspiration by seeking something authentic and progressive that meaninglessly conflates education and life. Such an opposition characterizes some of the cruder representations of traditional/conservative versus progressive/critical education, and it is not helpful for understanding the proper place of pedagogical reduction. A proper understanding of the educational need for interpretation and reduction provides a more informed space for understanding the shared concerns of the traditional and conservative, as well as the progressive and critical, the shared concerns of how to represent the complex world to the young.

1. The term “pedagogical reduction” gives no results in searches within four major journals in the field of philosophy and education: *Journal of Philosophy of Education*, *Educational Theory*, *Educational Philosophy and Theory*, and *Studies in Philosophy and Education*.

2. Klaus Mollenhauer, *Forgotten Connections: On Culture and Upbringing*, trans. Norm Friesen (London: Routledge, 2013).

3. *Online Etymology Dictionary*, s.v. “educe (v.),” accessed January 27, 2019, https://www.etymonline.com/word/educe.

4. Bonnie Rochman, “Bye-Bye, Training Wheels. Hello, Balance Bikes,” *Time,* September 30, 2011, http://healthland.time.com/2011/09/30/bye-bye-training-wheels-hello-balance-bikes-learning-to-ride-a-bike-has-never-been-so-easy/.

5. Daniel Tröhler, “The Knowledge of Science and the Knowledge of the Classroom: Using the Heidelberg Catechism (1563) to Examine Overlooked Connections,” in *Scholarly Knowledge: Textbooks in Early Modern Europe*, ed. Emidio Campi, Simone De Angelis, Anja-Silvia Goeing, and Anthony Grafton (Geneva, Switzerland: Librarie Droz, 2008), 79.

6. Ibid.

7. While intention is central to this process, it need not be assumed that this intention resides only with the direct agent of education — the teacher in front of the student — since that intention might be designed into curricula or the objects that teachers then, consciously or sometimes unconsciously, take up. For instance, insofar as the balance bike is designed with the pedagogy of cycling in mind, then the object can be seen as a pedagogical reduction itself. This allows us to see the pedagogical reduction both as a process enacted by educators (of selection and simplification), as well as a product of that process (the balance bike or textbook).

8. Shaun Gallagher, *Hermeneutics and Education* (Albany: State University of New York, 1992), 37.

9. Ibid., 79. This complication becomes apparent when Gallagher suggests that the presentation not only includes but also exceeds the teacher's understanding, and so cannot be defined as a "subset."

10. Tröhler, "The Knowledge of Science and the Knowledge of the Classroom," 81.

11. Martin Buber has considered selection of the active world as vital component in education; see Buber, *Between Man and Man* (London: Routledge, 2002). Wolfgang Klafki has developed an influential *Didaktik* analysis that focuses on the exemplary in his book chapter "Didaktik Analysis as the Core of Preparation of Instruction," in *Teaching as a Reflective Practice: The German Didaktik Tradition*, ed. Ian Westbury, Stefan Hopmann, and Kurt Riquarts (London: Routledge, 2015), 139–160.

12. See Martin Wagenschein, "Teaching to Understand: On the Concept of the Exemplary in Teaching," in *Teaching as a Reflective Practice*, ed. Westbury, Hopmann, and Riquarts, 161–175.

13. Conversely, it could be argued that the German *Didaktik* tradition has failed to move quickly enough to critique. My thanks to the reviewers for drawing my attention to this point.

14. See, for example, Michael Apple, *Official Knowledge: Democratic Education in a Conservative Age* (London: Routledge, 2000).

15. See Ian Westbury, "Teaching as a Reflective Practice: What Didaktik Might Teach Curriculum," in *Teaching as a Reflective Practice*, ed. Westbury, Hopmann, and Riquarts, 15–39.

16. Mollenhauer, *Forgotten Connections*. See also Norm Friesen and Tone Saevi, "Reviving Forgotten Connections in North American Teacher Education: Klaus Mollenhauer and the Pedagogical Relation," *Journal of Curriculum Studies* 42, no. 1 (2010): 123–147; and Tone Saevi, "Mollenhauer and the Pedagogical Relation: A General Pedagogic from the Margins," *Phenomenology & Practice* 8, no. 2 (2014): 39–44.

17. Mollenhauer, *Forgotten Connections*, 53.

18. One of the first to use this term is Gustav Grüner, “Die didaktische Reduktion als Kernstück der Didaktik” [The Didactic Reduction as the Core of Didactics], *Die deutsche Schule*, no. 7–8 (1967): 414–430.

19. Arnold Kirsch, “Aspects of Simplification in Mathematics Teaching,” in *Teaching as a Reflective Practice*, ed. Westbury, Hopmann, and Riquarts, 267.

20. Stefan Hopmann and Kurt Riquarts, “Starting a Dialogue: A Beginning Conversation Between Didaktik and the Curriculum Traditions,” in *Teaching as a Reflective Practice*, ed. Westbury, Hopmann, and Riquarts, 3–11.

21. Gallagher, *Hermeneutics and Education*, 83.

22. See Robert A. Segal, “In Defense of Reductionism,” *Journal of the American Academy of Religion* 51, no. 1 (1983): 97–124.

23. See Richard Anderson, “The Notion of Schemata and the Educational Enterprise,” in *Schooling and the Acquisition of Knowledge*, ed. Richard C. Anderson, Rand J. Spiro, and William E. Montague (Oxford: Wiley, 1978); and Gallagher, *Hermeneutics and Education*, chap. 3.

24. Norm Friesen, *The Textbook and the Lecture* (Baltimore, MD: Johns Hopkins University Press, 2017), chap. 7.

25. Ibid., 102.

26. Aristotle*, Poetics*, trans. Malcolm Heath (London: Penguin, 1996), chap. 9.

27. Johann Friedrich Herbart, *Herbart’s A B C of Sense-Perception, and Minor Pedagogical Works* (New York: D. Appleton, 1896). See also Max van Manen, *The Tact of Teaching* (Albany: State University of New York Press, 1992).

28. Mollenhauer, *Forgotten Connections*, 31.

29. Ibid.

30. Ibid., 46.

31. John Amos Comenius, *Orbis Sensualium Pictus* [The Visible World in Pictures], trans. Charles Hoole (Syracuse, NY: C. W. Bardeen, 1887), 1, https://www.gutenberg.org/files/28299/28299-h/28299-h.htm.

32. Ibid., xii.

33. Although the text introduces the reader to geometry (p. 126), it does not introduce mathematics, or "number," as such, This point seems significant, but is beyond the scope of this essay.

34. Comenius, *Orbis Sensualium Pictus*, xiii.

35. John Dewey, *Democracy and Education* (New York: Macmillan, 1916), 7.

36. Ibid., 24.

37. Gallagher, *Hermeneutics and Education*, 241.

38. This point resonates with an interesting development in educational theory, the appeal to a post-critical pedagogy: Naomi Hodgson, Joris Vlieghe, and Piotr Zamojski, *Manifesto for a Post-Critical Pedagogy* (Goleta, CA: Punctum Books, 2018). Here, the first principle is simply that there are principles to defend.

39. Gallagher, *Hermeneutics and Education*, chap. 8.

40. Matthew Crawford, *Shop Class as Soulcraft: An Inquiry into the Value of Work* (London: Penguin, 2009), 11.

41. See Jan Masschelein and Maarten Simons, *In Defence of School: A Public Issue*, trans. Jack McMartin (Leuven, Belgium: E-ducation, Culture & Society, 2013). Masschelein and Simons refer to the Greek idea of *scholè* as "free time for study and practice afforded to people who had no claim to it according to the archaic order prevailing at the time," 9.

42. Ilmi Willbergh, "The Problems of 'Competence' and Alternatives from the Scandinavian Perspective of *Bildung*," *Journal of Curriculum Studies* 47, no. 3 (2015): 343.

43. Klafki, "Didaktik Analysis as the Core of Preparation of Instruction", 152.

44. It should be acknowledged that the German tradition of *bildung* is often understood, first, as a type of self-formation, though consideration of this would take us beyond the central argument being developed.

45. Matthew Arnold, *Culture and Anarchy* (Oxford: Oxford University Press, 2009), 5.

46. Henry Giroux, “Toward a Pedagogy of Critical Thinking,” in *Re-Thinking Reason: New Perspectives in Critical Thinking*, ed. Kerry S. Walters (Albany: State University of New York Press, 1994), 200–201.

47. Gallagher, *Hermeneutics and Education*, 246–261.

48. Heidegger’s concept of truth involves a creative retrieval of *aletheia*, translated as “unconcealment,” emphasizing the hermeneutical condition since every revealing of what is, is also a concealing. See, for instance, Martin Heidegger, *On Time and Being* (New York: Harper and Row, 1972), 70; and Martin Heidegger, “On the Essence of Truth,” in *Basic Writings*, ed. David Farrell (New York: Harper and Row, 1977).

49. See, for instance, bells hooks, *Teaching to Transgress: Education as the Practice of Freedom* (London: Routledge, 1994); and Ira Shor, “What Is Critical Literacy?” *Journal of Pedagogy, Pluralism, and Practice* 1, no. 4 (1999): art. 2.

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